

# PATENT ABSTRACTS OF JAPAN

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(21)Application number : 04-341020

(71)Applicant : TOSHIBA CERAMICS CO LTD

(22)Date of filing : 30.11.1992

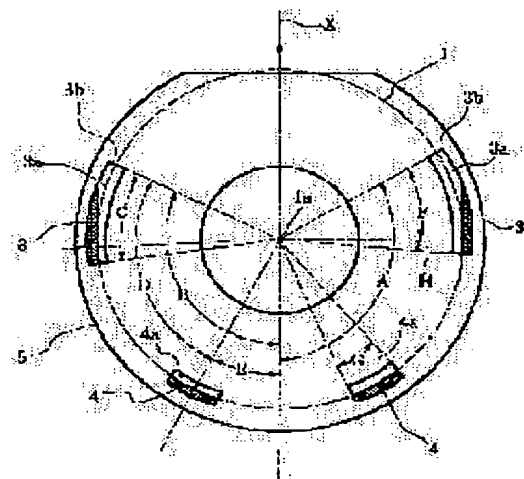
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## (54) VERTICAL BOAT

### (57)Abstract:

**PURPOSE:** To provide the vertical boat making no slip at all even if large size wafers are loaded to be heat-treated.

**CONSTITUTION:** Within the vertical boat wherein multiple supporting members 3, 4 are arranged in the vertical direction so that respective multiple semiconductor wafers 1 may be loaded in multiple trenches 3a, 4a formed on the supporting members 3, 4 at specific intervals, the supporting member 3 positioned on the insertion starting end side takes a sectional arc shape while the angle made by the wafer center with the wafer inserting direction X on the front end of the supporting members 3 is specified to exceed  $100^\circ$  further increasing in the outer peripheral direction of the wafers.



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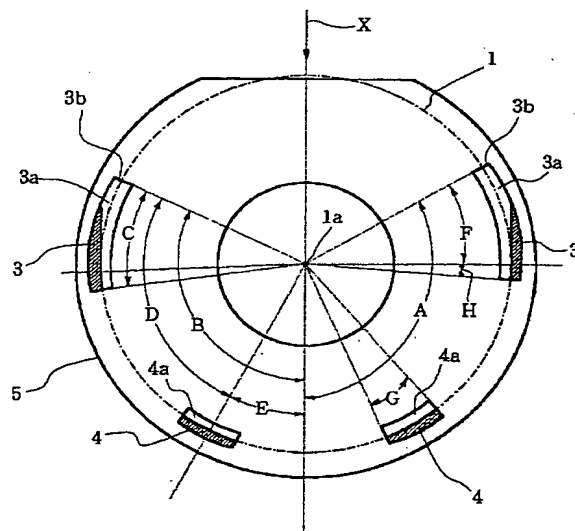
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(54)【発明の名称】 縦型ポート

(57)【要約】 (修正有)

【目的】 この発明は、大きな寸法のウエハを積載して熱処理をしてもスリップが生じない縦型ポートを提供する。

【構成】 複数の支持部材3、4を縦方向に配列して、それらの支持部材に所定の間隔で形成された複数の溝3a、4aにそれぞれ複数の半導体ウエハ1を積載するためのウエハ用縦型ポートにおいて、ウエハの挿入始端側に位置する支持部材3の形状が断面アーク状であり、かつ該支持部材の前方端は、ウエハの中心とウエハの挿入方向Xとのなす角度を100度以上にしてウエハの外周方向に増大させたことを特徴とする縦型ポート。



## 【特許請求の範囲】

【請求項1】 複数の支持部材を縦方向に配列して、それらの支持部材に所定の間隔で形成された複数の溝にそれぞれ複数の半導体ウエハを積載するためのウエハ用縦型ポートにおいて、ウエハの挿入始端側に位置する支持部材の形状が断面アーク状であり、かつ該支持部材の前方端は、ウエハの中心とウエハの挿入方向とのなす角度を100度以上にしてウエハの外周方向に増大させたことを特徴とする縦型ポート。

## 【発明の詳細な説明】

## 【0001】

【産業上の利用分野】この発明は、複数の支持部材を縦方向に配列して、それらの支持部材に所定の間隔で形成された複数の溝にそれぞれ複数の半導体ウエハを積載するための縦型ポートに関する。

## 【0002】

【従来の技術】半導体ウエハの酸化・拡散処理工程では、多数の半導体ウエハをウエハ用ポートに積載して、そのままウエハ用ポートを拡散炉内部に搬入して、そこでウエハの所望の熱処理を行う。

【0003】拡散炉の種類に応じて縦型ポートを使用したり、横型ポートを使用したりしている。

【0004】図1に示すように、従来の縦型ポートは、ウエハ1（図1には1枚だけ代表的に示してある）を水平に支持するために複数（図1の例では4本）の支持部材2が縦方向に配列されている。それらの支持部材2には所定の間隔で複数の溝2aが内向きに形成されている。それらの複数の溝2aにそれぞれ複数のウエハ1を鉛直方向に沿って積載する。

【0005】なお、図1には支持部材2の直径を見やすくするために誇張して示してあるが、実際のものは相当に細い棒材を使用している。

【0006】従来の縦型ポートは、全ての支持部材2が同一断面形状の棒材であった。例えば、断面形状は円形や正方形であった。このような断面形状の棒材に形成された溝2aは、ウエハ1に接触する面積が小さく、溝2aの支持面のウエハ外周方向の幅が小さかった。一方、ウエハを安定させるために、ウエハの挿入方向と90度の位置に支持部材を配置しているが、ウエハの挿入始端側に位置する支持部材の前方端は、ウエハの中心とウエハの挿入方向とのなす角度が90度を僅かに（例えば数度）越すだけであった。

## 【0007】

【発明が解決しようとする課題】ポートは、支持部材2によってウエハ1を支持した状態で熱処理時に高温にさらされる。すると、特にウエハ1が大きな寸法のものである場合、ウエハ1の重量で撓み現象を生じやすい。その時、ウエハ1をポートの所定位置に積載した状態で、ウエハ1の挿入始端側に位置する支持部材2の前方端は、ウエハ1の中心とウエハ1の挿入方向とのなす角度

が図1の例のように90度を僅かに（例えば数度）越すものであると、ウエハ1の重心がウエハ1の挿入始端側に位置する対向する2つの支持部材2の前方端間にごく近くに位置し、ウエハの挿入始端側に位置する指示部材に荷重負担は偏ってしまう。例えば、ウエハの挿入始端側に位置する1対の支持部材に70～90パーセントの荷重応力が負荷される。ウエハが大型であると、荷重応力によりウエハ1がスリップを起こす危険が生じる。ここでいうスリップとは、偏荷重により支持部に接触するウエハ部分内に結晶欠陥（転位）を生じることである。一方、大型のウエハの荷重応力を緩和させるための手段として実開昭62-128633号には円弧状板を支持棒に固定した形状が提案されているが、面精度を出すのが困難で高価になる。

【0008】この発明は、このような従来技術の欠点を解消して、大きな寸法のウエハを積載して熱処理をしてもウエハに欠陥が発生し難い縦型ポートを提供することを目的としている。

## 【0009】

20 【課題を解決するための手段】この発明は、複数の支持部材を縦方向に配列して、それらの支持部材に所定の間隔で形成された複数の溝にそれぞれ複数の半導体ウエハを積載するためのウエハ用縦型ポートにおいて、ウエハの挿入始端側に位置する支持部材の形状が断面アーク状であり、かつ該支持部材の前方端は、ウエハの中心とウエハの挿入方向とのなす角度（A、B）を100度以上にしてウエハの外周方向に増大させたことを特徴とする縦型ポートを要旨としている。

## 【0010】

30 【発明の効果】この発明によれば、半導体ウエハをポートの所定位置に積載した状態で、ウエハの挿入始端側に位置する支持部材の前方端と、ウエハの中心と、ウエハの挿入方向とのなす角度が100度以上であるので、ウエハの重心がウエハの挿入始端側に位置する対向する2つの支持部材の前方端間から相当に奥に入ったところに位置する。その結果、ウエハの挿入始端側に位置する支持部材への荷重負担が軽減され、ウエハに欠陥を生じる危険が回避される。たとえばスリップ（ウエハ単結晶中の結晶格子に乱れを生じること）が回避できる。

40 【0011】角度を100度以上としたのは、実験を重ねることにより100度以上（さらに好ましくは115度以上）にすればウエハの偏荷重現象を回避できることが判明したからである。

## 【0012】

【実施例】図2は、この発明の第一実施例を示している。同一の断面アーク状の支持部材3を縦方向に互いに平行に配置している。これらの支持部材3の上方端部と下方端部にはそれぞれ従来と同様に固定手段が設けられているが、図示を省略している。支持部材3には所定の間隔で複数の溝3aが形成されている。4本の支持部材

3の断面形状は全て同一であるが、溝3aの形は、全てが同じではない。ウエハ1の挿入始端側に位置する2つの対向する支持部材3は、溝3aの底がウエハ1の挿入方向Xと平行になるように形成してある。換言すると、ウエハ1の外周円の接線方向に溝3aの底が沿っている。ウエハ1の挿入後端側に位置する2つの支持部材3は、溝3aの底がウエハ1の外周縁に対応したアーキ形状になっている。ウエハ1をボートの所定位置に積載した状態で、ウエハ1の挿入始端側に位置する支持部材3aの前方端3bと、ウエハ1の中心1aと、ウエハ1の挿入方向Xとのなす角度A、Bが約118度である。

【0013】図2の実施例で使用されている支持部材3は、4本ともウエハ1の外周方向に延びた断面アーキ形状の板材料であり、図2の状態ではウエハ1の中心1aから支持部材3の両側になす角度は約30〜40度になっており、溝3aの深さは、3mm〜7mmである。また、支持部材3の4本は溝3aを含めてウエハ1の挿入方向Xに対して線対称に配置されている。

【0014】図3は、この発明の第2実施例を示している。

【0015】2対の断面アーキ状の支持部材3、4を縦方向に互いに平行に配置している。4本の支持部材3、4はすべて同一の厚みを有する。支持部材3、4の外周と内周はウエハ1の外周円とほぼ同心になっている。これらの支持部材3、4の上方端部と下方端部にはそれぞれ従来と同様に固定手段が設けられているが、一方の固定手段5だけを示し、他方の固定手段は図示を省略している。ウエハ1の挿入始端側に位置する2本の対向する支持部材3には所定の間隔で複数の溝3aが形成されている。これらの2本の対向する支持部材3の断面形状は同一であり、ウエハ1の外周方向における幅が広く設定してある。このようにウエハ1の挿入始端側に位置する2つの対向する支持部材3は、溝3aの底がウエハ1の挿入方向Xと平行になるように（つまりウエハ1の接線方向に）形成してある。ウエハ1の挿入後端側に位置する2つの支持部材4は、ウエハ1の挿入始端側に位置する2本の対向する支持部材3よりも狭い幅の板形状であって、軽量化が図られている。溝4aの底はウエハ1の外周縁に対応したアーキ形状になっている。ウエハ1をボートの所定位置に積載した状態で、ウエハ1の挿入始端側に位置する支持部材3の前方端3bと、ウエハ1の中心1aと、ウエハ1の挿入方向Xとのなす角度A、Bは約120度である。

【0016】図3の実施例においてウエハ1の挿入始端側で使用されている支持部材3は、2本とも幅が64mmの断面アーキ形状の板材料であり、図3の状態ではウエハ1の中心1aから支持部材3の両側端になす角度Cは約36度になっている。溝3aの深さは、3mm〜10mmである。他方のウエハ1の挿入後端側の支持部材4

は、2本とも幅が30mmの断面アーキ形状の板材料であり、図3の状態ではウエハ1の中心1aからウエハ1の挿入始端側までの角度A、Bは、約120度になっている。溝4aの深さは、3mm〜10mmである。

【0017】また、支持部材3及び4の4本は溝3a、4aを含めてウエハ1の挿入方向Xに対して線対称に配置されている。

【0018】なお、図3において、角度Dは約90度、Eは30度、Fは33度、Gは17度、Hは約3度である。

【0019】前述の支持部材3、4はウエハ1の直径よりも大きな外径とウエハ1の直径よりも小さな内径を有する円管を所定形状に切断して作ることができる。その後、それらの支持部材3、4に積載すべきウエハの枚数分だけスリットを形成して溝3a、4aを作り、しかる後、それらの支持部材3、4に上下の固定手段（板）を固定する。

【0020】この発明は前述の実施例に限定されるものではない。例えば、支持部材4は1本の場合もあり、丸棒でもよい。また、角度Aと角度Bを相違させてもよい。

【0021】一方、図2及び3の実施例ではウエハ1の挿入始端側に位置する2つの対向する支持部材3は溝3aの底がウエハ1の挿入方向Xと平行になるように（つまりウエハ1の外周円の接線方向に）形成してあったが、それよりもさらに外側に開くように形成することもできる。

【0022】表1に示すウエハの応力や変位量は、発生する変位量および応力の各最大値であり、計算機によるシミュレーションで求めたものである。従来の対応するタイプのボートと比較して、本発明品の応力や変位量が大幅に少ないことが分かる。

【図面の簡単な説明】

【図1】従来の縦型ボートの概略を示す図。

【図2】この発明の第1実施例による縦型ボートの概略を示す図。

【図3】この発明の第2実施例による縦型ボートの概略を示す図。

【符号の説明】

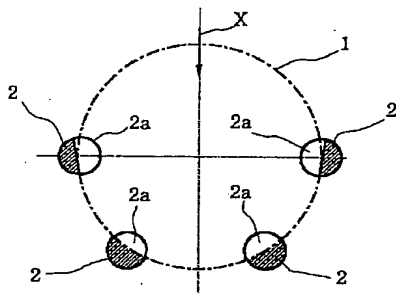
- 1 ウエハ
- 1a ウエハの中心
- 2 支持部材
- 3 支持部材
- 3a 溝
- 4 支持部材
- 4a 溝

◆  
【表1】

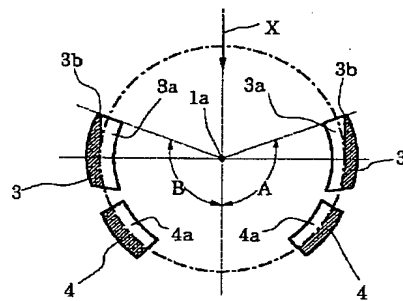
	最大変位量 (mm)	相当応力 (MPa)	最大主応力 (MPa)	半径方向応力 (MPa)	周方向応力 (MPa)
本発明品	0.0180	0.6367	0.6984	0.1678	0.6841
従来品	0.1158	1.5010	1.7220	0.6956	1.7180

最大主応力、半径方向応力、周方向応力ともにウェハ表面に発生した応力である。

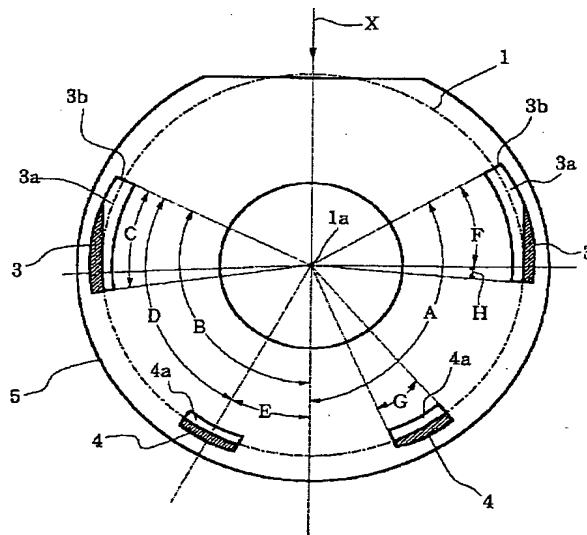
【図1】



【図2】



【図3】



フロントページの続き

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(5)

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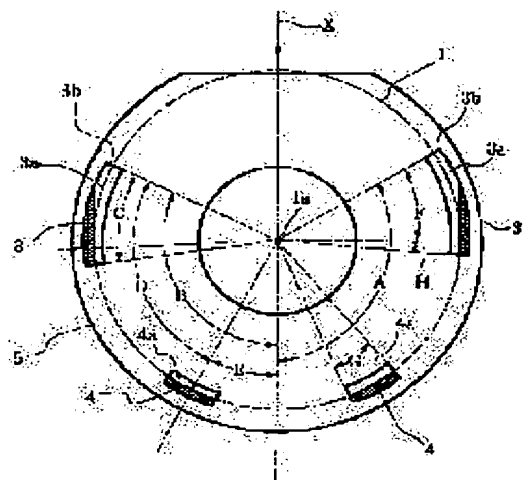
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## (54) VERTICAL BOAT

(57)Abstract:

PURPOSE: To provide the vertical boat making no slip at all even if large size wafers are loaded to be heat-treated.

CONSTITUTION: Within the vertical boat wherein multiple supporting members 3, 4 are arranged in the vertical direction so that respective multiple semiconductor wafers 1 may be loaded in multiple trenches 3a, 4a formed on the supporting members 3, 4 at specific intervals, the supporting member 3 positioned on the insertion starting end side takes a sectional arc shape while the angle made by the wafer center with the wafer inserting direction X on the front end of the supporting members 3 is specified to exceed 100° further increasing in the outer peripheral direction of the wafers.



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CLAIMS

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[Claim(s)]

[Claim 1] In the vertical mold boat for wafers for loading two or more semi-conductor wafers into two or more slots which arranged two or more supporter material to the lengthwise direction, and were formed in those supporter material at the predetermined spacing, respectively It is the vertical mold boat which the configuration of the supporter material located in the insertion start edge side of a wafer is a cross-section arc-like, and is characterized by for the front edge of this supporter material having made the include angle of the core of a wafer, and the path of insertion of a wafer to make 100 degrees or more, and increasing it in the direction of a periphery of a wafer.

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[Translation done.]



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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention arranges two or more supporter material to a lengthwise direction, and relates to the vertical mold boat for loading two or more semi-conductor wafers into two or more slots formed in those supporter material at the predetermined spacing, respectively.

[0002]

[Description of the Prior Art] At oxidization and the diffusion-process process of a semi-conductor wafer, many semi-conductor wafers are loaded into the boat for wafers, the boat for wafers is carried in to the interior of a diffusion furnace as it is, and the request of a wafer is heat-treated there.

[0003] According to the class of diffusion furnace, a vertical mold boat is used or the horizontal-type boat is used.

[0004] As shown in drawing 1, in order that the conventional vertical mold boat may support horizontally a wafer 1 (only one sheet is typically shown in drawing 1), the supporter material 2 of plurality (the example of drawing 1 4) is arranged in the lengthwise direction. Two or more slot 2a at predetermined spacing is formed in the inner sense at those supporter material 2. Two or more wafers 1 are loaded into two or more of those slot 2a along the direction of a vertical, respectively.

[0005] In addition, although it is exaggeratingly shown in order to make the diameter of the supporter material 2 legible at drawing 1, the actual thing is using the fairly thin bar.

[0006] All the supporter material 2 of the conventional vertical mold boat was bars of the same cross-section configuration. For example, cross-section configurations were a round shape and a square. Slot 2a formed in the bar of such a cross-section configuration had a small area in contact with a wafer 1, and its width of face of the direction of a wafer periphery of the back face of slot 2a was small. On the other hand, although supporter material was arranged in the path of insertion of a wafer, and the location of 90 degrees in order to stabilize a wafer, the front edge of the supporter material located in the insertion start edge side of a wafer only exceeded slightly [ the include angle of the core of a wafer, and the path of insertion of a wafer to make ] (for example, abundance) 90 degrees.

[0007]

[Problem(s) to be Solved by the Invention] A boat is exposed to an elevated temperature at the time of heat treatment, where a wafer 1 is supported by the supporter material 2. Then, when especially the wafer 1 is the thing of a big dimension, it is bent by weight of a wafer 1 and is easy to produce a phenomenon. The front edge of the supporter material 2 then located in the insertion start edge side of a wafer 1 where a wafer 1 is loaded into the predetermined location of a boat. If the include angle of the core of a wafer 1 and the path of insertion of a wafer 1 to make exceeds 90 degrees slightly (for example, abundance) like the example of drawing 1 A load burden will incline toward the directions member to which the center of gravity of a wafer 1 is located very much in near, and is located at the insertion start edge side of a wafer between the front edges of two supporter material 2 which is located in the insertion start edge side of a wafer 1, and which counters. For example, the load of 70 - 90% of the load stress is carried out to one pair of supporter material located in the insertion start edge side of a wafer. Risk of a wafer 1 causing a slip with load stress as a wafer is large-sized arises. A slip here is producing a crystal defect (rearrangement) in the wafer part which contacts a supporter according to an unbalanced load. Although the configuration which fixed the circular plate to the bearing bar is proposed by JP,62-128633,U as a means for on the other hand making the load stress of a large-sized wafer ease, it is difficult to send profile irregularity and it becomes expensive.

[0008] This invention cancels the fault of such a conventional technique, and even if it heat-treats by loading the wafer of a big dimension, it aims at offering the vertical mold boat which a defect cannot generate easily

to the wafer.

[0009]

[Means for Solving the Problem] In the vertical mold boat for wafers for loading two or more semi-conductor wafers into two or more slots which this invention arranged two or more supporter material to the lengthwise direction, and were formed in those supporter material at the predetermined spacing, respectively. The vertical mold boat which the configuration of the supporter material located in the insertion start edge side of a wafer is a cross section arc-like, and is characterized by for the front edge of this supporter material having made the include angle ( A, B) of the core of a wafer and the path of insertion of a wafer to make 100 degrees or more, and increasing it in the direction of a periphery of a wafer is made into the summary.

[0010]

[Effect of the Invention] According to this invention, where a semi-conductor wafer is loaded into the predetermined location of a boat, since the include angle of the front edge of the supporter material located in the insertion start edge side of a wafer, the core of a wafer, and the path of insertion of a wafer to make is 100 degrees or more, it is located in the place where the center of gravity of a wafer went into the back fairly from between the front edges of two supporter material which is located in the insertion start edge side of a wafer, and which counters. Consequently, the load burden to the supporter material located in the insertion start edge side of a wafer is mitigated, and risk of producing a defect to a wafer is avoided. For example, a slip (produce turbulence in the crystal lattice in a wafer single crystal) is avoidable.

[0011] It is because it became clear that the unbalanced load phenomenon of a wafer was avoidable when making to have made the include angle into 100 degrees or more into 100 degrees or more (still more preferably 115 degrees or more) by repeating an experiment.

[0012]

[Example] Drawing 2 shows the first example of this invention. The supporter material 3 of the shape of same cross-section arc is mutually arranged in parallel to the lengthwise direction. Illustration is omitted although the fixed means is formed in the upper part edge and lower part edge of these supporter material 3 as usual, respectively. Two or more slot 3a at predetermined spacing is formed in the supporter material 3. Although all of the cross-section configuration of four supporter material 3 are the same, the form of slot 3a does not have the same all. Two supporter material 3 which is located in the insertion start edge side of a wafer 1 and which counters is formed so that the bottom of slot 3a may become the path of insertion X of a wafer 1, and parallel. If it puts in another way, the bottom of slot 3a meets the tangential direction of the periphery circle of a wafer 1. Two supporter material 3 located in the insertion back end side of a wafer 1 is the arc configurations corresponding to the periphery edge of a wafer 1 in the bottom of slot 3a. It is in the condition which loaded the wafer 1 into the predetermined location of a boat, and the include angles A and B of front edge 3b of supporter material 3a located in the insertion start edge side of a wafer 1, core 1a of a wafer 1, and the path of insertion X of a wafer 1 to make are about 118 degrees.

[0013] The supporter material 3 currently used in the example of drawing 2 is the charge of a plate of the cross-section arc configuration prolonged in the direction of a periphery of a wafer 1 by four, the include angle made on both sides of the supporter material 3 is about 30 - 40 degrees from core 1a of a wafer 1 in the state of drawing 2 , and the depth of slot 3a is 3mm - 7mm. Moreover, four of the supporter material 3 are arranged to the path of insertion X of a wafer 1 at axial symmetry including slot 3a.

[0014] Drawing 3 shows the 2nd example of this invention.

[0015] The supporter material 3 and 4 of the shape of two pairs of cross-section arcs is mutually arranged in parallel to the lengthwise direction. Four supporter material 3 and 4 has the same thickness altogether. The periphery and inner circumference of the supporter material 3 and 4 are this alignment mostly with the periphery circle of a wafer 1. Although the fixed means is formed in the upper part edge and lower part edge of these supporter material 3 and 4 as usual, respectively, only one fixed means 5 is shown and, as for the fixed means of another side, illustration is omitted. Two or more slot 3a at predetermined spacing is formed in two supporter material 3 are located in the insertion start edge side of a wafer 1 and which counters. The cross-section configuration of these two supporter material 3 that counters is the same, and the width of face in the direction of a periphery of a wafer 1 is set up widely. Thus, two supporter material 3 which is located in the insertion start edge side of a wafer 1 and which counters is formed so that the bottom of slot 3a may become the path of insertion X of a wafer 1, and parallel (to that is, tangential direction of a wafer). Two supporter material 4 located in the insertion back end side of a wafer 1 is the plate configurations of width of face narrower than two supporter material 3 are located in the insertion start edge side of a wafer 1 and which counters, and lightweight-ization is attained. The bottom of slot 4a is an arc configuration corresponding to the periphery edge of a wafer 1. It is in the condition which loaded the wafer 1 into the

predetermined location of a boat, and the include angles A and B of front edge 3b of the supporter material 3 located in the insertion start edge side of a wafer 1, core 1a of a wafer 1, and the path of insertion X of a wafer 1 to make are about 120 degrees.

[0016] Both of the supporter material 3 currently used by the insertion start edge side of a wafer 1 in the example of drawing 3 is the charges of a plate of the cross-section arc configuration where width of face is 64mm, and the include angle C made at the both-sides edge of the supporter material 3 from core 1a of a wafer 1 in the state of drawing 3 is about 36 degrees. The depth of slot 3a is 3mm - 10mm. Both of the supporter material 4 by the side of the insertion back end of the wafer of another side is the charges of a plate of the cross-section arc configuration where width of face is 30mm, and the include angles A and B by the side of the insertion start edge of a wafer 1 are about 120 degrees from core 1a of a wafer 1 in the state of drawing 3. The depth of slot 4a is 3mm - 10mm.

[0017] Moreover, four of the supporter material 3 and 4 are arranged to the path of insertion X of a wafer 1 at axial symmetry including Slots 3a and 4a.

[0018] In addition, for E, in drawing 3, F is [ an include angle D / H of G ] about 3 times 17 degrees 33 degrees 30 degrees about 90 degrees.

[0019] The above-mentioned supporter material 3 and 4 can cut and make \*\*\*\* which has a bore smaller than a bigger outer diameter than the diameter of a wafer 1, and the diameter of a wafer 1 in a predetermined configuration. Then, a slit is formed by the number of sheets of the wafer which should be loaded into those supporter material 3 and 4, Slots 3a and 4a are made, and an up-and-down fixed means (plate) is fixed to those supporter material 3 and 4 after an appropriate time.

[0020] This invention is not limited to the above-mentioned example. For example, the supporter material 4 may also have the case of one and the round bar is sufficient as it. Moreover, an include angle A and an include angle B may be made different.

[0021] On the other hand, in drawing 2 and the example of 3, two supporter material 3 which is located in the insertion start edge side of a wafer 1 and which counters was formed so that the bottom of slot 3a might become the path of insertion X of a wafer 1, and parallel (to that is, tangential direction of the periphery circle of a wafer), but it can also form so that it may open outside further rather than it.

[0022] The stress and the amount of displacement of the wafer shown in Table 1 are each maximum of the amount of displacement to generate, and stress, and are calculated in the simulation by the computer. As compared with the boat of the type with which the former corresponds, it turns out that there are few the stress and the amounts of displacement of this invention article sharply.

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[Translation done.]

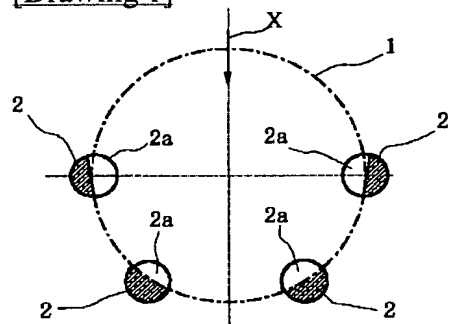
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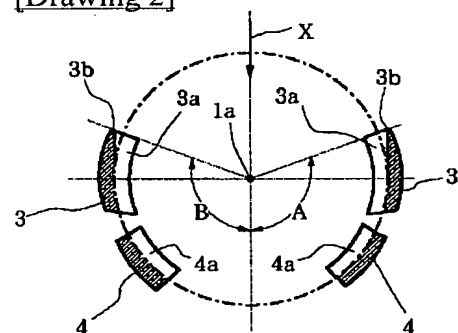
1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

## DRAWINGS

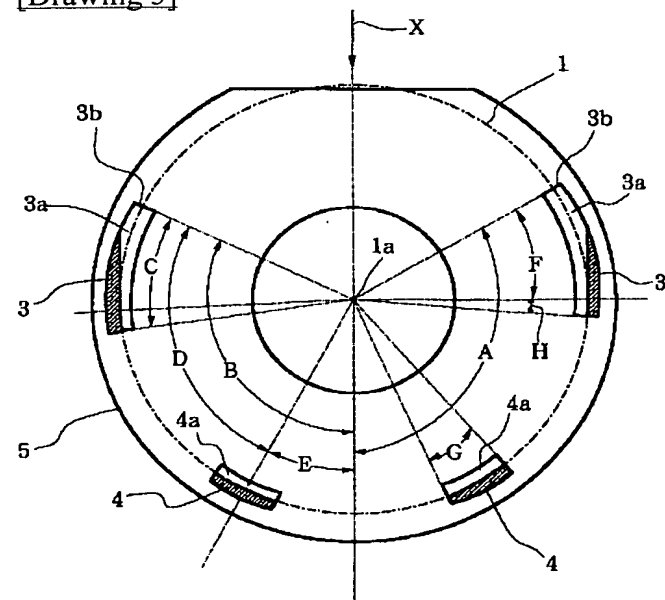
[Drawing 1]



[Drawing 2]



[Drawing 3]



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[Translation done.]